LAMONT GEOLOGICAL OBSERVATORY
Columbia University
Palisades, New York

Design and Construction of a Lunar Seismograph

Contract No. NASw-82

Progress Report #10

1 October to 31 December 1961

SUMMARY OF PROGRESS

Development has been carried forward on first and second generation lunar seismograph systems during the present report period. Preparation for handling and analysis of Ranger data at Lamont has been continued and the prototype of the Surveyor seismograph system has entered the fabrication phase.

I. Ranger Data Analysis

Ranger data analysis equipment procurement, installation and calibration have been completed. Instant moonquake signals have been applied to the system and satisfactorily reproduced. Various filters, etc., have been tested to insure optimum data evaluation techniques. Using other tape-recorded earthquake and microseism signals, various techniques, such as Fourier and power spectral measurements, inverse filtering, frequency vs. time, and cumulative power vs. time measurements, are being developed. A paper on one phase of this work "Energy Studies Using Wide-band Magnetic Tape Seismographs" by Paul W. Pomeroy and George H. Sutton will be presented at the spring meeting of the Seismological Society of America at the University of Southern California. These techniques will be available for use on the Ranger and Surveyor data.

Attached is a self explanatory flow diagram of the data handling capability being established at Lamont for seismic data reduction and analysis. Most of the boxes shown are filled

or being filled at present.

II. Surveyor Program

Design and fabrication of the prototype model of the seismograph system for the Surveyor lunar soft landing program are progressing satisfactorily. The instrument is to undergo operational testing during the next report period. A more detailed discussion of the design of the Surveyor seismograph will be found in the monthly progress reports for Jet Propulsion Laboratory Contract No. 950157.

Results of the thermal studies initiated during the previous report period and discussed briefly in the October 30 progress report indicate that satisfactory thermal control can be achieved by a double radiation shield. The inner shield will encase the instrument and the outer shield will spread a cover over the instrument and the adjacent portion of the lunar surface.

A complete discussion of this investigation is to be presented at the spring meeting, in Washington, of the American Geophysical Union under the title "Lunar Temperatures and Their Interaction with a Lunar Instrument" by Ludo Van Hemelrijck, Peter Tea, George H. Sutton and Victor Paschkis.

Detailed study of a passive compensation technique for limiting thermal drifts and period variations in a long-period vertical seismometer has produced sufficient improvements over standard techniques to warrent its incorporation into the

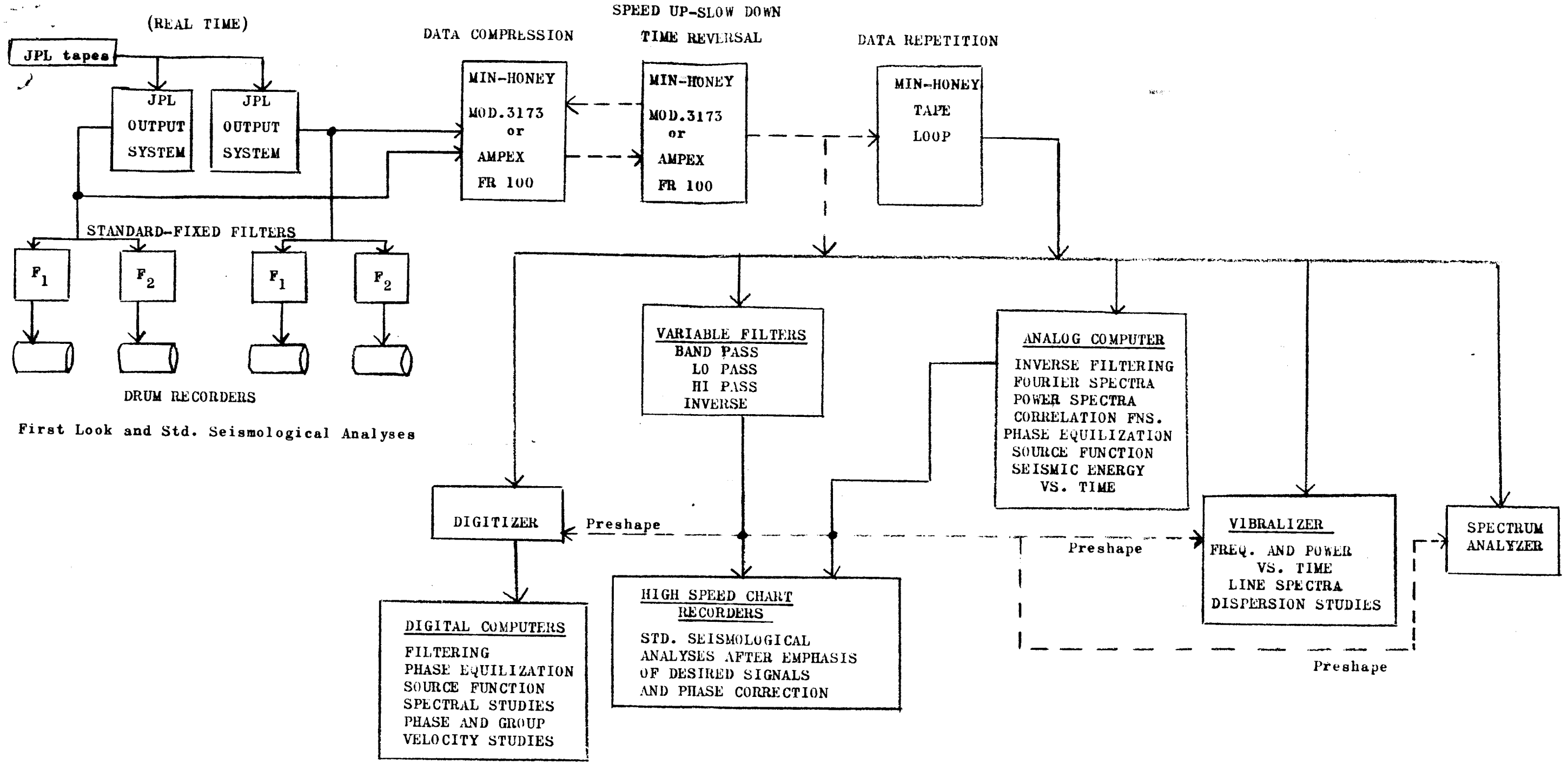
Surveyor seismograph prototype. The method employs relative motions between invar and aluminum members in horizontal and vertical directions to limit position and period variations normally associated with temperature cycles.

Analyses of several types of coarse level sensors to detect off-level in excess of six minutes have been tested. Mercury bulb switches, pendulus switches, and electrolytic cells have been under investigation.

The reduced gravity field on the moon causes a variation in the relationship between gravity forces and viscous forces making prediction of the sensitivity of fluid sensing devices difficult. The smaller gravity field also reduces by six the contact pressures available for switch type sensors.

In addition, the operational temperature cannot, at this time, be predicted except that it will be between -20°C and +100°C (limited to $\pm$20°C within this range). This limits the accuracy to which the viscous forces can be estimated.

The electrolytic cell appears to suffer the least degradation in the lunar environment and is to be incorporated into the prototype unit.



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